Final Project: Analysis of a Punch

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Course: Physics 201
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Lab analysis (1)

Objective: To digitize our average punch (left and right punch) and analyze the footage to find force, momentum, velocity, and acceleration.

Equipments:
1. Sony digital camcorder.
2. Gateway laptop.
3. Logger Pro. (Version 3.3)
4. Meter stick

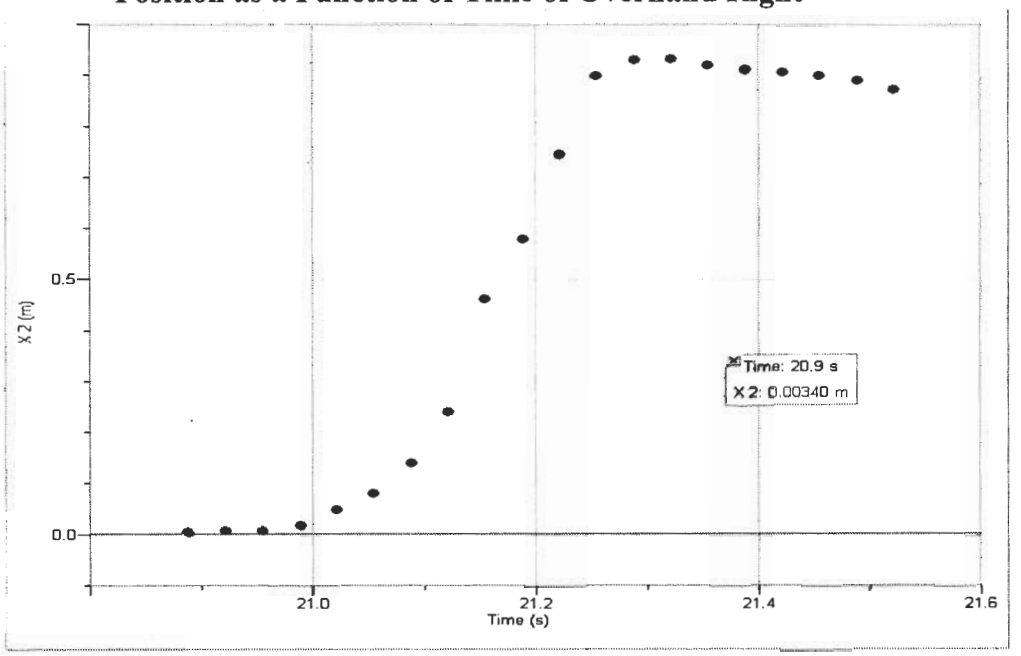
Procedure:
1. To obtain a room in the Wellness Center.
2. Set up camera on tripod.
3. Orient ourselves in view of camera with meter stick to show scale.
4. Capture raw video of a jab punch and overhand right punch.
5. Use Windows Movie Maker to import video footage from camera.
6. Use Logger Pro. (Version 3.3) to digitize and analyze video.
7. Interpret results.

Data:

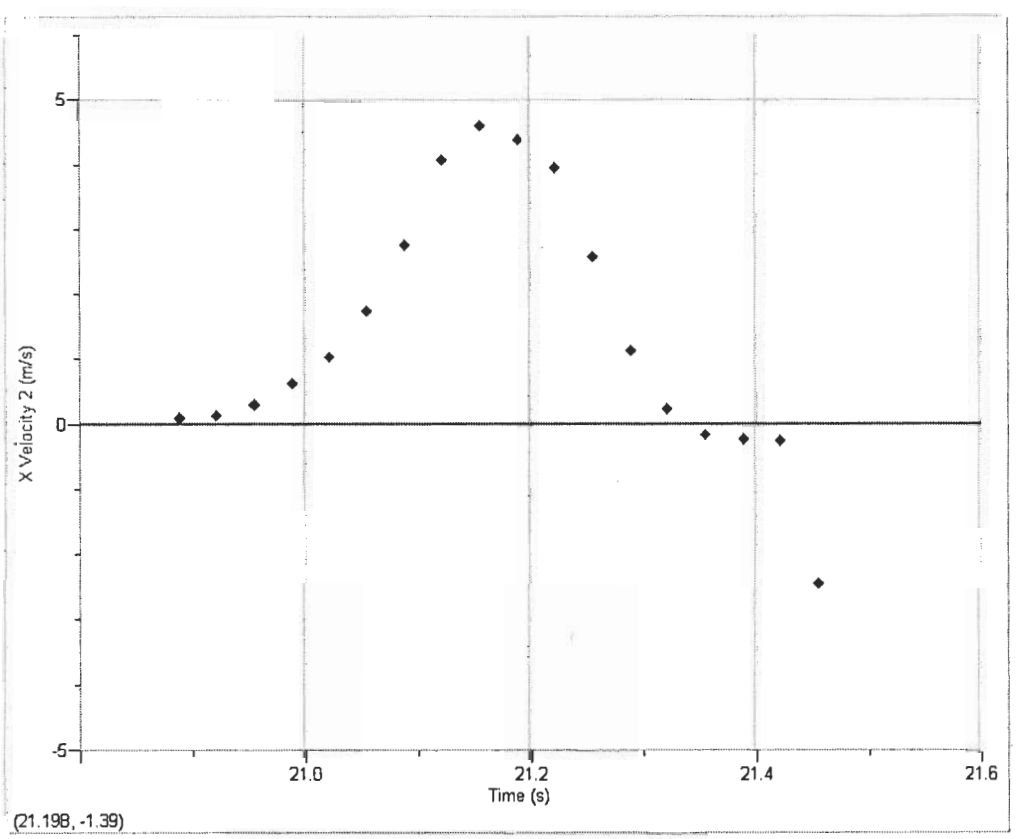
Punch #1 Overhand Right

Time(s)	X(m)	Vx(m/s)	P(kg m/s)	F(N)	KE(J)
20.888	0.003	0.089	0.267		0.012
20.921	0.007	0.135	0.406	8.94	0.028
20.955	0.007	0.288	0.864	21.50	0.124
20.988	0.017	0.613	1.839	33.58	0.564
21.021	0.048	1.033	3.100	50.37	1.602
21.055	0.082	1.734	5.201	77.45	4.509
21.088	0.139	2.754	8.263	105.33	11.380
21.121	0.241	4.072	12.216	82.73	24.872
21.155	0.463	4.591	13.774	13.65	31.620
21.188	0.578	4.378	13.133	-28.76	28.748
21.221	0.745	3.953	11.858	-80.97	23.436
21.255	0.898	2.575	7.724	-126.94	9.944
21.288	0.929	1.131	3.392	-105.73	1.918
21.321	0.932	0.228	0.683	-58.49	0.078
21.355	0.918	-0.168	-0.504	-20.13	0.042
21.388	0.912	-0.221	-0.663	-3.45	0.073
21.421	0.905	-0.245	-0.734	-99.92	0.090
21.455	0.898	-2.449	-7.348	-276.68	8.998
21.488	0.888	-6.391	-19.173	-584.33	61.266
21.521	0.871	-15.421	-46.264	-879.43	356.725

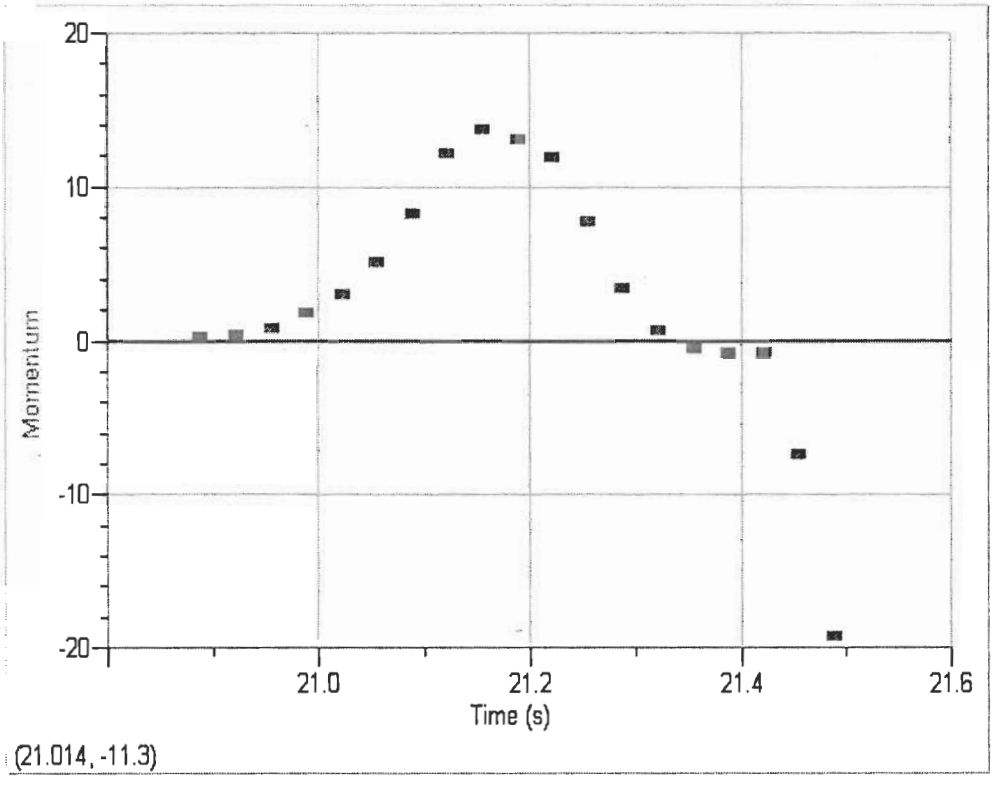
Position as a Function of Time of Overhand Right



Velocity as a Function of Time of Overhand Right

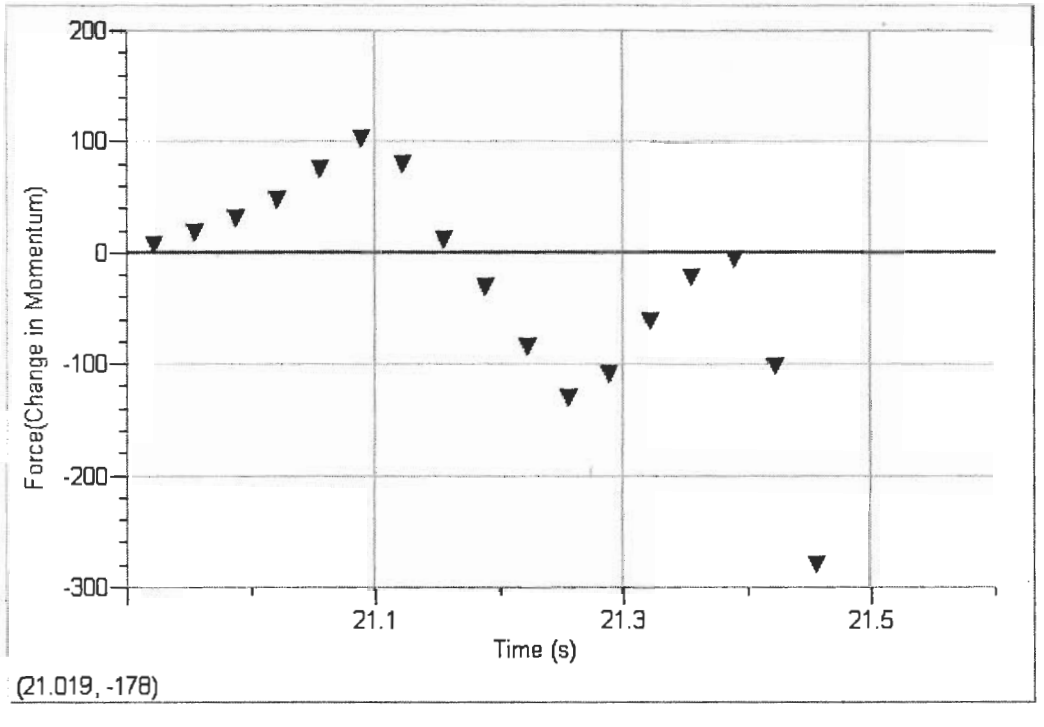


Momentum as a Function of Time of Overhand Right

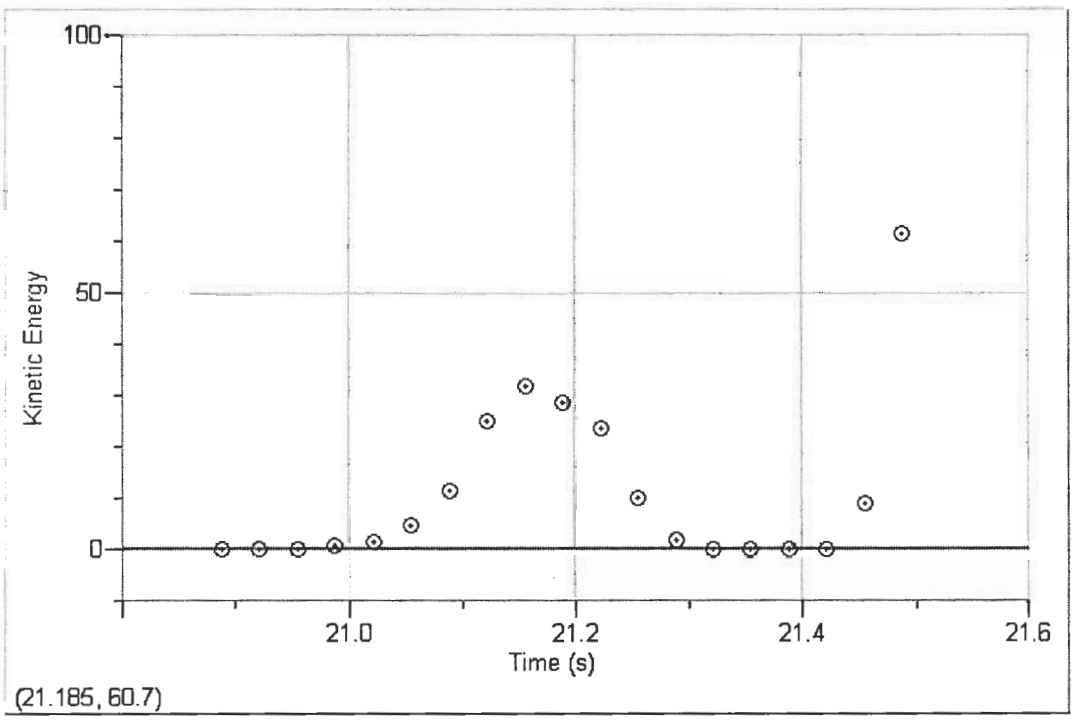


this is a force on some 3kg object. The arm/hand combo ??

Force(dp/dt) as a Function of Time of Overhand Right



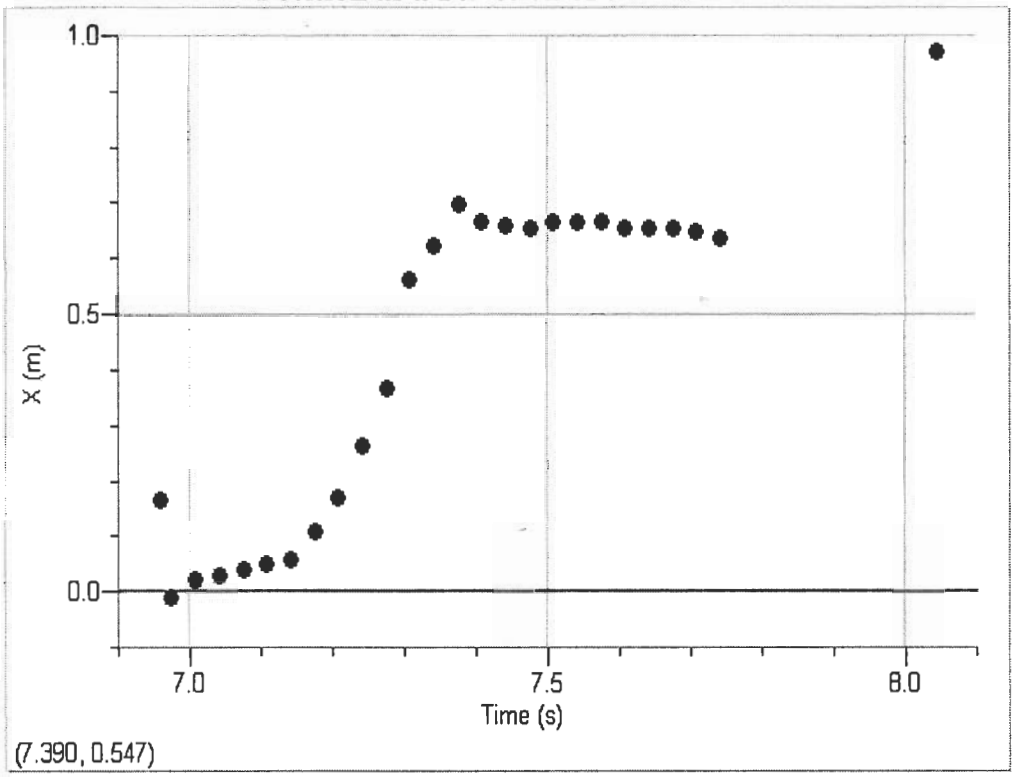
Kinetic Energy as a Function of Time of Overhand Right



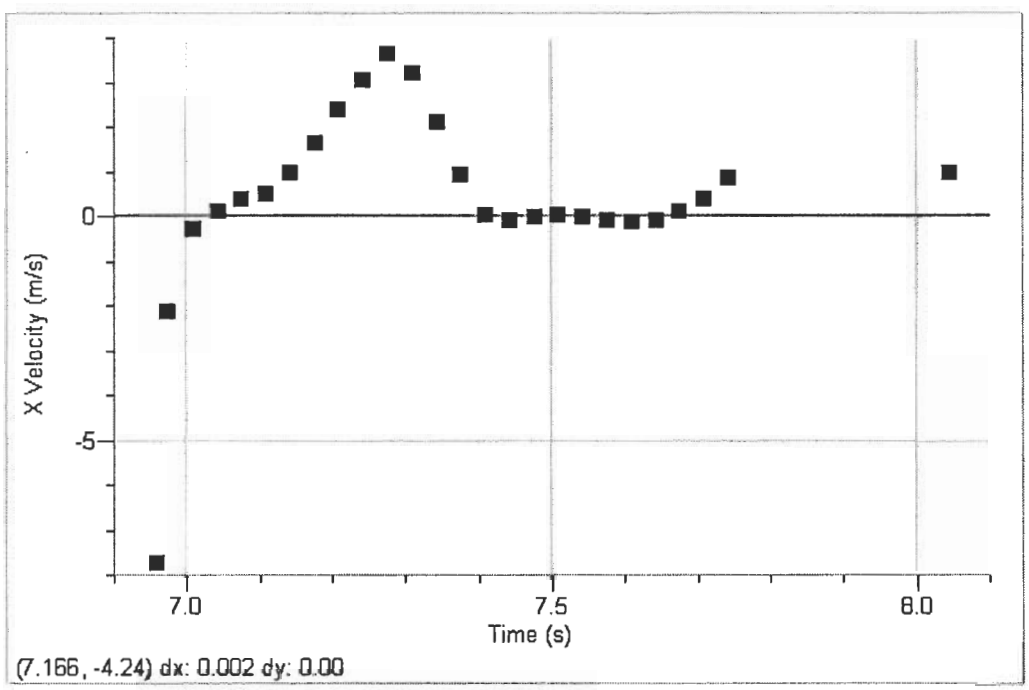
Punch #2 Jab

Time(s)	X(m)	Vx(m/s)	P(kg m/s)	F(N)	KE(J)
6.958	0.167	-7.733	-23.200		89.707
6.973	-0.010	-2.132	-6.397	831.58	6.819
7.008	0.020	-0.288	-0.864	96.03	0.125
7.042	0.031	0.122	0.367	29.90	0.022
7.075	0.041	0.376	1.129	17.29	0.213
7.108	0.051	0.506	1.519	27.53	0.385
7.142	0.058	0.988	2.965	51.02	1.465
7.175	0.109	1.640	4.921	62.79	4.036
7.208	0.171	2.383	7.150	63.86	8.521
7.242	0.263	3.059	9.178	56.47	14.040
7.275	0.369	3.639	10.916	6.99	19.858
7.308	0.560	3.215	9.644	-69.01	15.501
7.342	0.621	2.105	6.314	-102.83	6.645
7.375	0.700	0.929	2.788	-93.27	1.296
7.408	0.666	0.032	0.097	-44.99	0.002
7.442	0.659	-0.070	-0.210	-2.24	0.007
7.475	0.655	-0.018	-0.053	5.63	0.000
7.508	0.666	0.055	0.165	0.55	0.005
7.542	0.666	-0.005	-0.016	-6.04	0.000
7.575	0.666	-0.079	-0.238	-4.54	0.009
7.608	0.655	-0.106	-0.319	-0.31	0.017
7.642	0.655	-0.086	-0.258	10.68	0.011
7.675	0.655	0.131	0.393	22.23	0.026
7.708	0.648	0.408	1.224	33.50	0.250
7.742	0.638	0.876	2.627	38.00	1.150
8.043	0.973	0.983	2.948		1.448

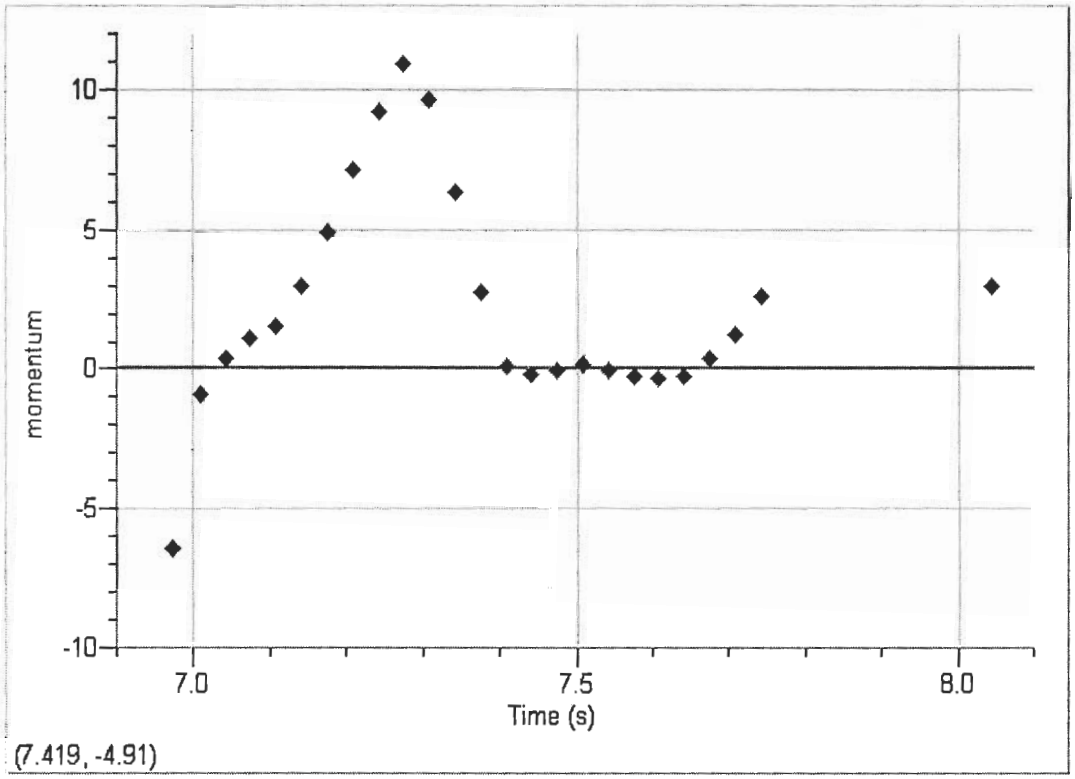
Position as a Function of time of Jab



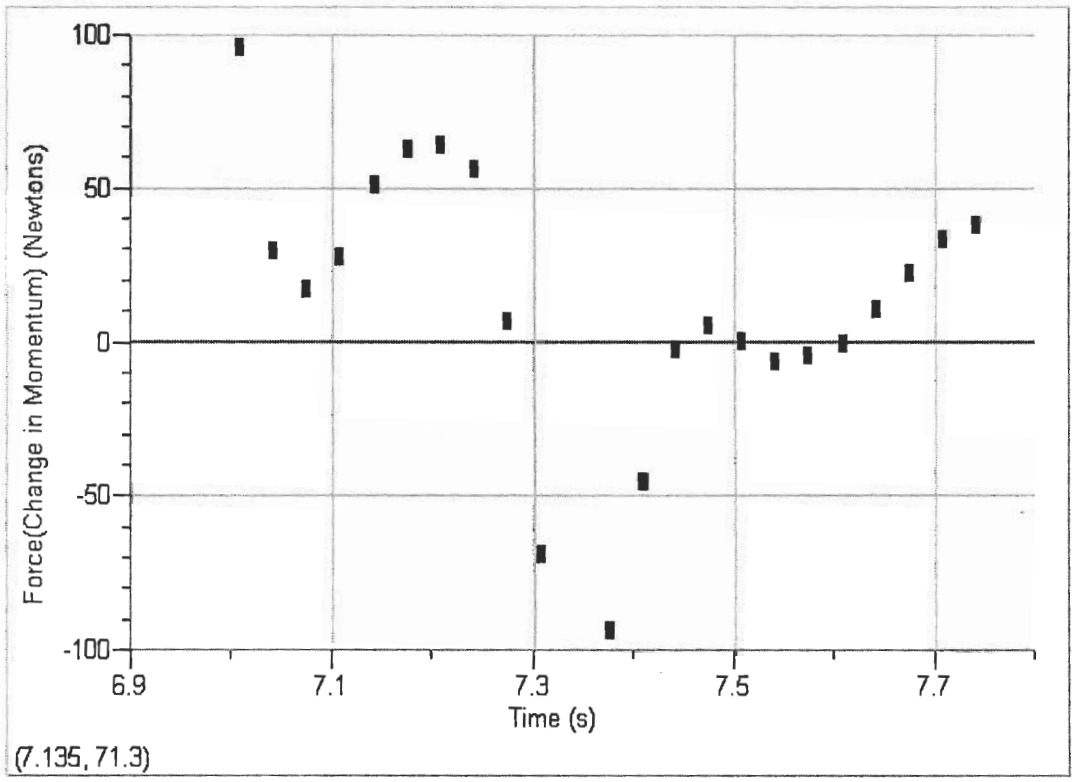
Velocity as a Function of Time of Jab



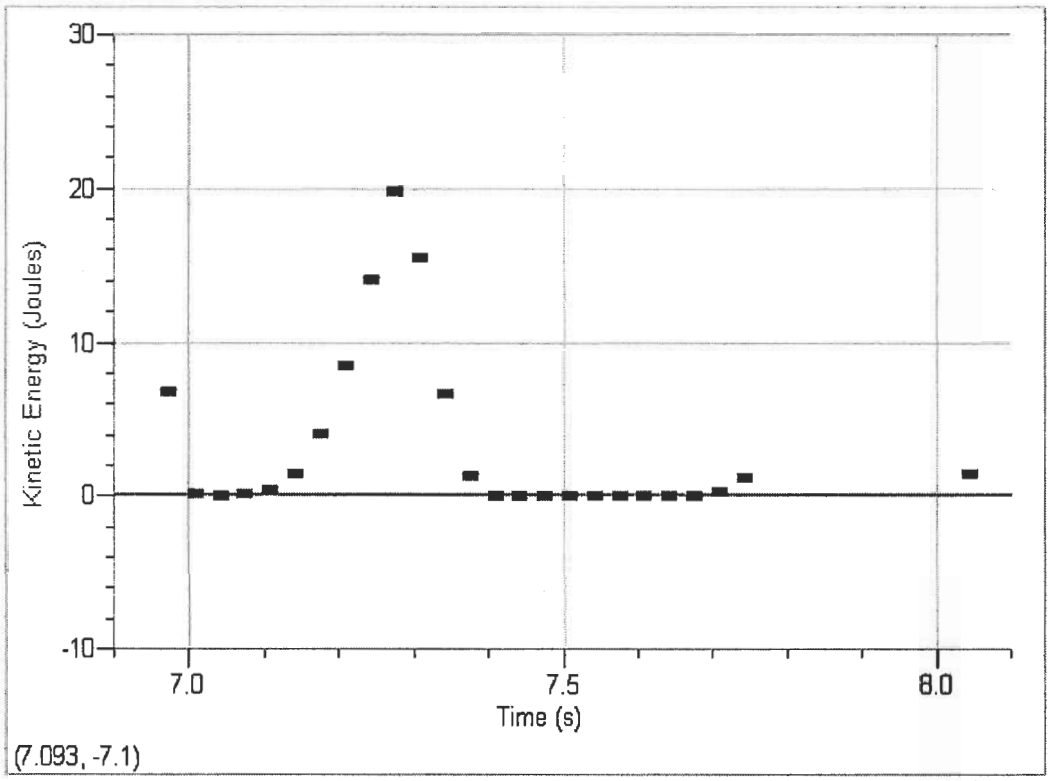
Momentum as a Function of Time of Jab



Force(dp/dt) as a Function of Time of Jab



Kinetic Energy as a Function of Time of Jab



not position?

Analysis: In the analysis of both punches the max of all categories is reached before impact, which seems counter intuitive. We suspected that the highest velocity would have been achieved moments before impact. This is clearly not the case. At about half of a meter from the target the velocity of the arm had reached its max. After half of a meter the velocity decreases to zero. Only a force in the negative direction could account for the decline of the velocity. That is exactly what we see when we look at the graph of force as a function of time. At about 21.1 seconds, which corresponds to a distance traveled of .25 meters, the force output by the arm has reached max and starts to decrease.

?. If you are studying the arm as your dynamical system, then is the net force on the arm, not anything "output" by the arm

Conclusion: It is very hard to come to a conclusion in this case. There numerous amounts of errors in the digitizing of the video as well the calculations. Our methods of analysis are crude at best. We would say that our guess is as good as any other. It might be wishful thinking to say: according to the data the distance which maximizes the force of impact is .5 meters. Around the moment of impact the data is incomprehensible. The dynamics of the impact are too complicated for a first year undergraduate student to contemplate.

and that's why you don't get into a boxers face !!